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# **OPERATING AND SERVICING MANUAL**

## **POWER SUPPLY MODEL PS-10**

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**OPERATING AND SERVICING MANUAL**  
**AP-3 AND PS-10 POWER SUPPLY**



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**January, 1961**

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subjected to individual systematic review.

## GENERAL DESCRIPTION

The   AP-3 and PS-10 power supplies are precision, transistorized power supplies which operate from 70 - 270V AC, 50 - 400 cps line voltage and deliver a regulated DC output, 12V, 2A, and an unregulated output, 12V, 5A. Also available is a source for battery charging (15V, regulated, 2.5A - 0.1A) output.

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## INSTRUCTIONS

### 1. Inspection

Unpack the supply carefully and inspect it for any damage which may have occurred in transit. If there is any damage, or if the instrument fails to operate properly when tested according to the instructions of Section 3, a claim should be filed with the carrier. Obtain a full report of the damage from the claim agent and send a copy of this report to us. Include the model number and serial number of the supply. Upon receipt of this we will advise you of the arrangements to be made for its repair or replacement.

### 2. Controls

A. Power Input: An integral two-prong plug is used for the input line power connection. Caution: Before connecting supply to power source, be sure switch S1 is completely counter clockwise in position "Off".

The input line cord and plug is at the rear of the supply for Model PS-10, and in a built-in compartment for Model AP-3.

B. Line Switch S1: This switch controls the input of line power to the power supply. Switch S1 should be set in "Off" position (completely counter clockwise) before starting any operation.

**C. Output Terminals:**

1. AP-3 The DC output connector is located in the compartment at the rear of the supply together with line cord. Both outputs are floating. The same output connector is used for operation A (12V, 2A, regulated, and 12V, 5A, unregulated) and for operation B (15V, regulated for battery charging).
2. PS-10 The DC output connector is located on the front panel of the power supply. Both outputs, 12V (regulated and unregulated) are floating. The same output connector is used for operation A (12V, 2A, regulated and 12V, 5A, unregulated) and for operation B (15V, regulated, for battery charging).

D. Regulated Output Voltage Adjust: The output voltage adjust potentiometer R9 is located on the main component board. The nominal range of adjustment of the voltage control is about 10% of the nominal output (12V). R9 is factory set for 12.0V and should not be readjusted.

E. Input Voltage Indicator (Voltmeter): This is located on the front panel of the power supply. The indicator has a three-color dial: Yellow, the undervoltage range from zero to almost nominal; green, the normal operation range with a center line which should be covered by the meter pointer as closely as possible; red, the overvoltage range.

NOTE: The power supply can operate safely only when the meter pointer is in the green sector of the dial. Prolonged operation in the red zone will damage the supply.

- F. Circuit Breakers: Three circuit breakers are provided in order to protect the power supply and external circuits against possible damage. They are located on the front panel.

CB1 2A breaker protects the input circuit, transformer and the main components of the power supply.

CB2 3A breaker protects the regulated output 12V, 2A. The rating of CB2 was determined by the initial battery charging current.

CB3 5A breaker protects the unregulated output, 12V, 5A.

All breakers are thermal type with delayed action, manually resettable

- G. Calibration Potentiometer R10: R10 for the voltmeter is located on the main board. This control is factory set and should not be reset or damage (overheating) to the power supply may occur during operation.

3. Operation A: (12V, 2A regulated and 12V, 5A unregulated.)

- A. Set the switch S1 on the front panel in "Off" position.
- B. Plug in line cord to an AC source.
- C. Connect the load (12V, 2A and 12V, 5A)
- D. Turn the power supply on by rotating the front panel switch S1 clockwise until the pointer on the input voltage indicator reaches as closely as possible to the center of the green sector.

NOTE: These power supplies were designed for one hour operation at a 50% duty cycle on the unregulated output (12V, 5A, max.) and a 100% duty cycle on the regulated output (12V, 2A, max.). Do not exceed one hour's operation. After one hour of operation, allow an hour for cooling before re-operating. The 50% duty cycle on the unregulated output is understood to be 45 seconds "on" followed by 45 seconds "off" and the supplies have been designed and tested for this mode of operation.

4. Operation B (Battery Charging)

- A. Set switch S1 on the front panel in "off" position.
- B. Plug in line cord to an AC source.
- C. Connect the battery to the power supply using special made connector which fits normal DC output connector and contains an integral jumper between pins 1 and 9.
- D. Turn the power supply on by turning the front panel switch S1 clockwise until the pointer on the input voltage indicator reaches as close as possible to the center of the green sector.

5. Maintenance and Trouble Shooting

- A. The supply does not require any periodic maintenance other than cleaning to remove excessive dust and dirt. If it is necessary to replace components use only first quality commercial components of values and types indicated. No selected components are used. When replacing components or trouble shooting, observe caution since dangerous voltages may exist in the power supply.

B. 1. Symptom: No output voltages.

Cause: Circuit breaker CB1 and/or CB2 - CB3 are open.

Repair Procedure: Check for short circuits, damaged rectifiers, shorted input capacitors or transformer before resetting breakers. Remove short circuit, if one exists.

2. Symptom: Poor regulation on the regulated output.

Cause: Switch S1 set at too low a value.

Repair Procedure: Move S1 clockwise to the next step.

3. Symptom: Poor regulation and output higher than nominal

Cause: The series regulating transistor Q1 is damaged.

Repair Procedure: Replace transistor.

4. Symptom: Power transformer overheated, high ripple.

Cause: One or more of the rectifiers CR1 to CR4 are defective.

Repair Procedure: Replace rectifier.

C. Typical Voltages at nominal input:

VOLTAGE ACROSS COMPONENT  
(At nominal line voltage)

<u>Component</u>	<u>Voltage</u>
Voltmeter	About 6.6V DC
C2	About 16V DC
C1	Nominal Output Voltage, depending on load
CR5	About 6.8V

All measurements should be taken with a 1000 ohms per voltmeter or better.

6. Circuit Description For AP-3 see Schematic 122C-0099  
For PS-10 see Schematic 123C-0099

The input AC power is transformed and rectified in the circuit consisting of transformer T1 and rectifiers CR1 - CR2 for the regulated output and CR3 - CR4 for the unregulated output. Capacitors C1 and C2 provide filtering for the unregulated output and for raw DC power for the regulated output, respectively. Rectified and filtered DC voltage is delivered through the circuit breaker CB3 to the unregulated output (12V, 5A). The raw power of the regulated supply passes through the series regulating transistor Q1 whose base is driven through driver Q2 and the comparator-amplifier Q3. Transistor Q3 compares the regulated output with a stable reference voltage developed across the Zener diode CR5. The difference voltage is amplified in Q3 and drives Q2. The same regulated output is used also for battery charging,

**6. Circuit Description (Cont'd)**

only the voltage is automatically increased to about 15V by connecting R8 by means of a jumper between pins 1 and 9 in the battery connector. Jumping pins 1 and 9 brings R8 across the lower part of the output voltage divider, thus increasing the output voltage.

Using the regulated output for battery charging operation has the advantage of automatic regulation of charging current rate. A completely discharged 12V nickel-cadmium battery of 5Ah capacity can be charged in less than 3 hours. The charging current drops automatically to less than 0.1A at the end of charging process, thus the battery can be charged unattended.

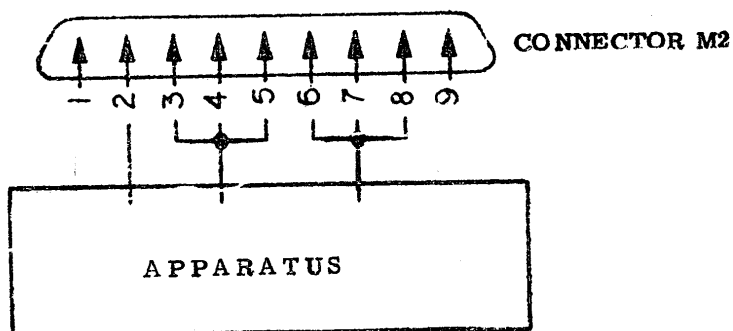
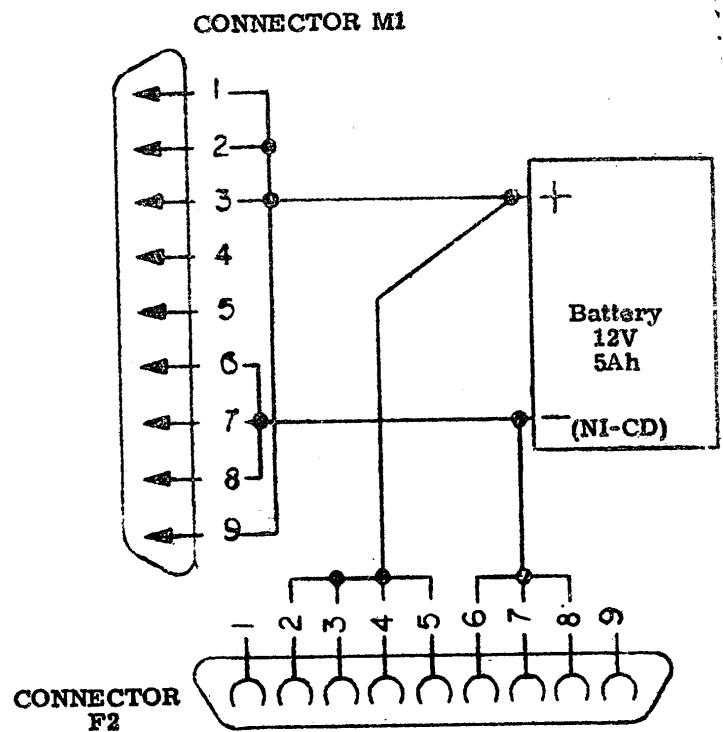
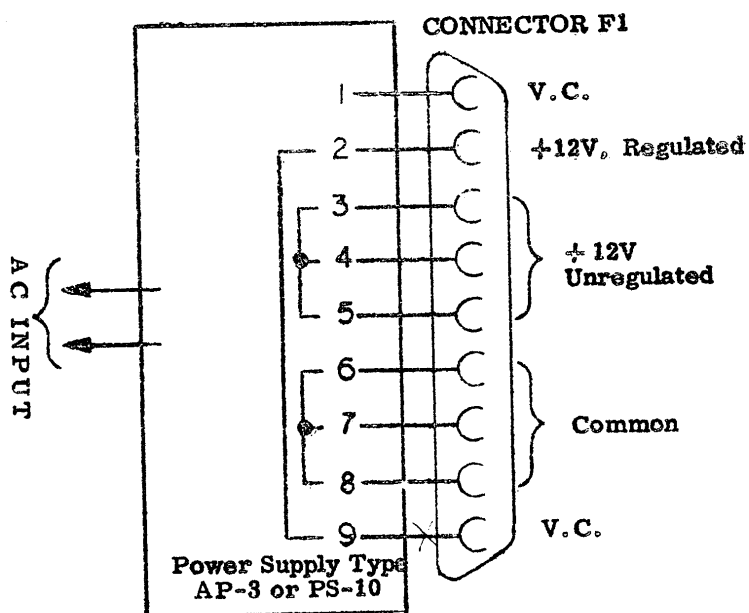


**7. CONNECTION FOR MODES OF OPERATION**

TYPE OF OPERATION	CONNECTION	DESCRIPTION OF OPERATION
A	M2 — F1	Operation of equipment from power supply. Battery not used.
B	M1 — F1	Battery Charging
C	M2 — F2	Operation from Battery. Power Supply not used.

**NOTE:**

1. Power Supply Type AP-3 and PS-10 can supply power to an ~~ix~~ instrument or can be used for battery charging, but for only one type of operation at a time.
2. See Diagram 122-0098 for interconnections.



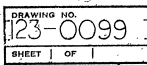
DRAWING NO. 122-0098

POWER SUPPLY  
TYPE AP-3 OR PS-10

Interconnections between Power Supply,  
Battery and Apparatus

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REVISIONS				
SYM.	ZONE	DESCRIPTION	DATE	APPROVAL
A		R110405 33k, R110405 56k, Color marking added.	2/15/61	gl



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DO NOT SCALE DRAWING		DATE 10-19-60		TITLE Laboratory P.S. SCHEMATIC P.S.J. 123-176		DRAWING NO. 123-0099		REV. A
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